

TECHNICAL REPORT #36

Smithsonian Institution &
The University of Arizona*

Secondary Mirrors Support:

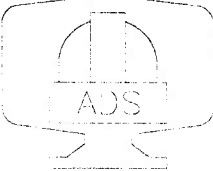

M2/F5 Hexapod Design Technical Report

& M2/F5 Hexapod Test Report

ADS International s.r.l.

May 2001



	MMT CONVERSION	 Steward Observatory
	Doc.No. : H5-RP-AD-99001 Issue : E Date : 17 May 2000	

MMT CONVERSION

SECONDARY MIRRORS SUPPORT

M2/F5 HEXAPOD DESIGN TECHNICAL REPORT

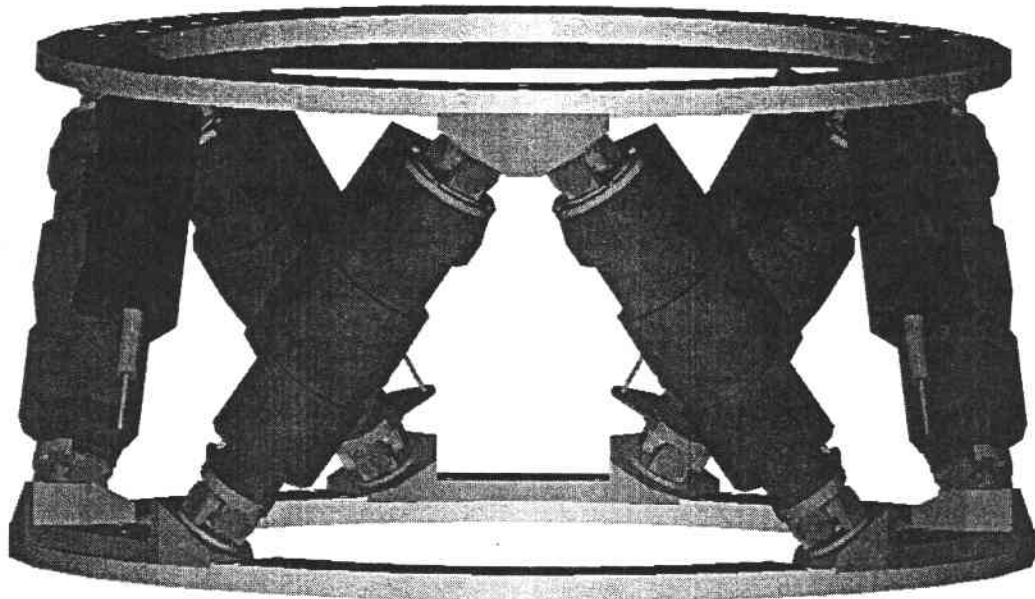
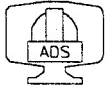


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APPLICABLE DOCUMENTS AND REFERENCES

1. Statement of Work (SOW), "The f/5 hexapod positioning system for the MMT Conversion Project", March 2nd 1999;
2. W.Gallieni, R.Pozzi; "MMT Conversion – Secondary Mirrors Support – M2/f15 and M2/f9 Hexapod Design – Technical Report", Issue 3, January 1997;
3. E-mail by S. West dated 7-Feb.-2000.

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1. INTRODUCTION

This document reports on the design of the hexapod supporting the $f/5$ secondary mirror.

The hexapod is designed accounting for the constraints given by the existing M2 hub and the mirror unit itself (ref. 1).

Hexapod static and dynamic analysis are studied by modelling the whole M2 hub in the $f/5$ configuration.

The $f/9$ - $f/15$ hexapod design (ref. 2) is assumed as baseline for the $f/5$ development.

2. HEXAPOD ORIENTATION

The hexapod layout is sketched in figure 1. The gravity vector shows the hexapod orientation with respect to the telescope elevation axis.

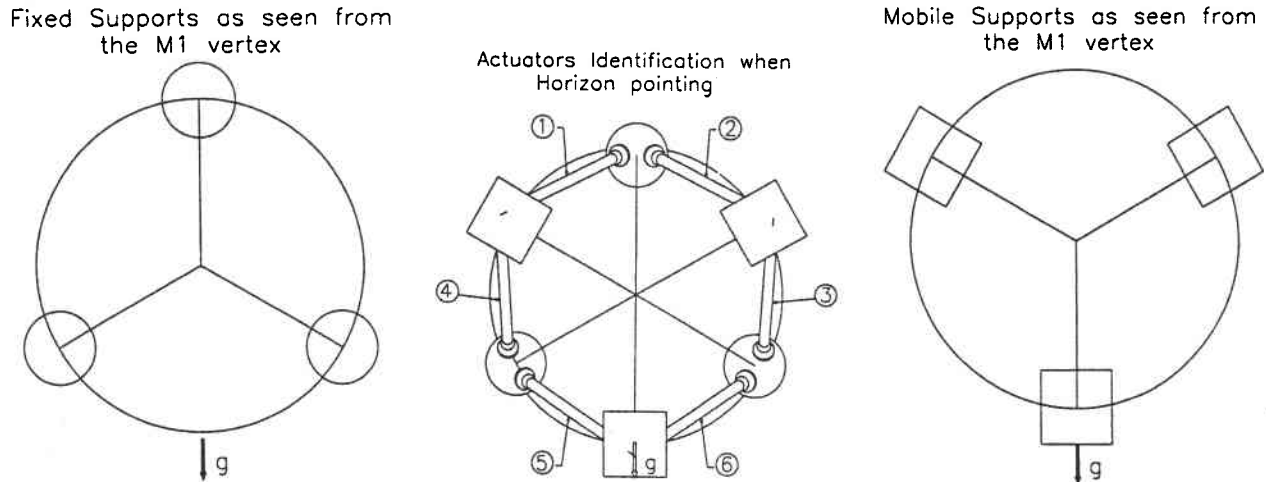
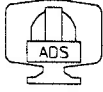


Figure 1. Hexapod orientation.

This orientation has been selected to minimise the difference between the forces in the actuators at different telescope elevations. The reverse one (with gravity upward in figure 1) leads to almost similar forces, while the 90 deg. rotated ones must be avoided.

The hexapod layout is specified to have the mirror c.o.g. placed onto the plane defined by the intersection of the six actuator axis (three pairs).

Moreover, the six hexapod axes should appear aligned on a triangle, when observed on the plan view of the hexapod wireframe (ref. 1).



3. KINEMATIC ANALYSIS

The kinematic model assumes the actuator length being the distance between the axis of its two joints, that is the kinematic joints is lumped on its center.

The mobile and fixed plates are defined by the kinematic joints plane.

The center of rotation is the mirror vertex. The mirror c.o.g. is centred on the plane defined by the actuators axis intersection, as specified by ref.1 – 3.2.2 .

The hexapod specifications (ref. 1) relevant to the kinematic design are hereafter reported:

- $Z = \pm 12 \text{ mm};$
- $X, Y = \pm 17 \text{ mm};$
- $TILT_{X,Y} = \pm 1.2 \text{ deg.}$

The kinematic model parameters are derived from the wireframe of hexapod layout.

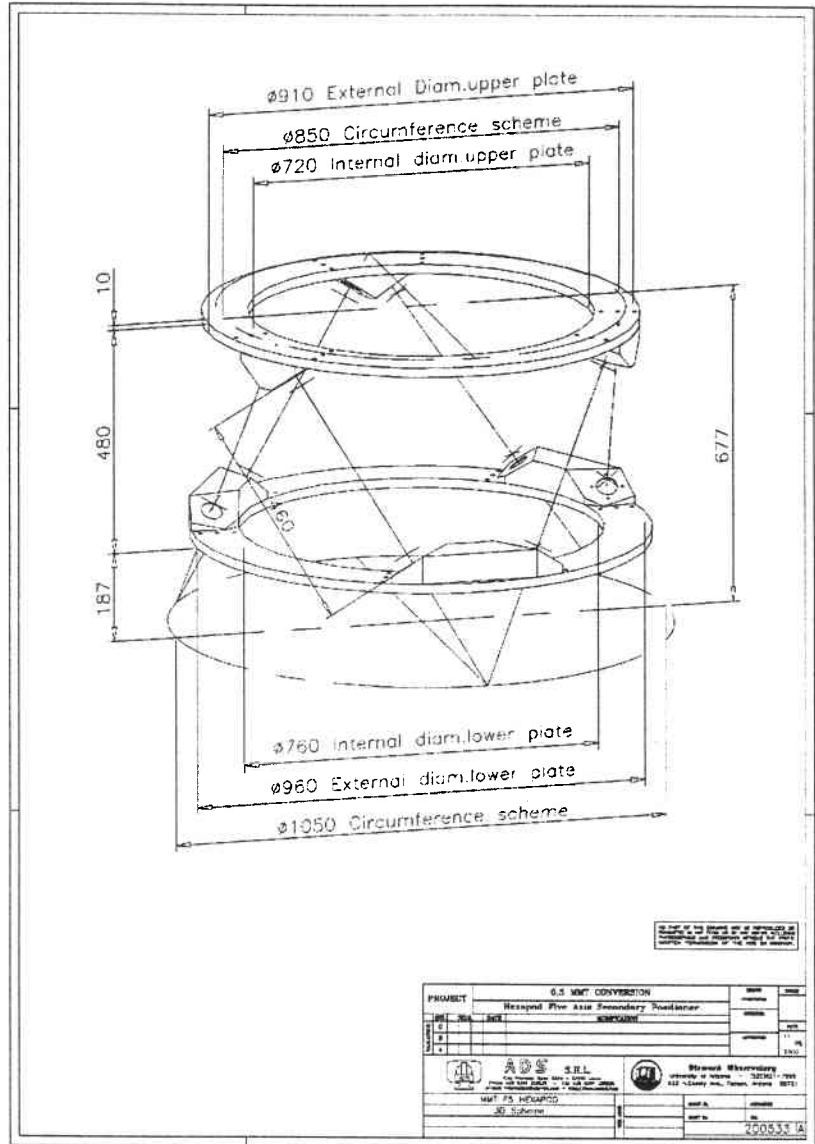


Figure 2. Hexapod wireframe.